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חוק הפטנטים, תשכ"ז-1967
Patent Law, 5727 - 1967

בקשה לפטנט
Application for Patent

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אני, (שם המבקש, מענו ולגבי גוף מאוגד - מקום התאגדותו)
I, (Name and address of applicant, and in case of body corporate-place of incorporation)

U.E.T. מיחזור מי תעשיה בע"מ
פארק תעשיה בניין 6A
עומר 84965

U.E.T. RECYCLING OF INDUSTRIAL WATER LTD.

ממציא: Inventor:
David ITZHAK

בעל ההמצאה מכח _____ שמה הוא
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ASSIGNMENT העברה

שיטה והתקן לטיפול במים
(בעברית) (Hebrew)

WATER TREATMENT METHOD AND DEVICE
(באנגלית) (English)

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This 30 of ספטמבר of the year 1997

חתימת המבקש
Signature of Applicant

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לשימוש הלישכה

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שיטה והתקן לטיפול במים

WATER TREATMENT METHOD AND DEVICE

WATER TREATMENT METHOD AND DEVICE

Field of the Invention

The present invention relates to water treating systems, particularly to scale removing and biocidical water treating systems.

Background of the Invention

The problem of scale is inherent to all systems in which there is a flow of water that contains any of Ca^{++} and Mg^{++} ions together with any of OH^-, CO_3^{--}, HCO_3^-, $SiO3^{--}$, or SO_4^{--} . Under the certain temperature and pH conditions, carbonates, silicates, sulfates and hydroxide salts precipitate and cause blockage of nozzles, reduction of cross-section area of pipes, heat insulation and underdeposit corrosion. The well known methods of removing scale from aqueous liquids are reverse osmosis and ion exchange. Another method for removing scale is direct current (DC) electrolysis. US 4,384,943 discloses a method of fluid treatment which comprises applying DC current to aqueous liquids.

Electrolysis treating of aqueous fluids to produce biocides is well known in the Art. For example, US 4,384,943 describes such a treatment which

comprises maintaining in the fluid a compound that is electrochemically decomposable to yield bromine, chlorine or iodine and/or by decomposing water to produce biocidally active O_2 or O_3 oxidants.

US 5,424,032 describes a method of treating water using innocuous chemicals for the treatment of microorganisms, or employing ultraviolet or electrolysis in order to destroy microorganisms.

The term "disinfecting" used herein means destroying various types of microorganisms to the extent that it prevents the formation of biological fouling.

As the actions of scale removing and scale preventing are related, each of the terms "scale removing" and "scale preventing" herein mean both scale removing and scale preventing.

It is a purpose of the present invention to provide a process for preventing or at least inhibiting the growth of microorganisms in aqueous solutions, e.g., water, and precipitating scale therefrom, which does not require the addition of chemicals, to said solutions, and thus is an environmental friendly process. For instance, there are cooling systems in which the water is treated by adding chemicals thereto. The blowdown stream of said cooling systems cannot be useful in many application due to said chemicals, and in many case said stream is wasted.

It is another purpose of the present invention to provide a process for disinfecting aqueous liquids and removing scale therefrom in systems wherein it is required to maintain the pH of about 7.

It has now been found, that in a system where a DC treatment having a combined effect of *in situ* production of biocides and of scale precipitation was applied to an aqueous fluid, e.g. pure water with no further additives, a dramatically lower percentage of scale was required to be precipitated, than described in the prior art, in order to achieve substantially the same results of disinfecting and scale removing, as of softened water described in the prior art.

Summary of the Invention

The present invention provides a method of treatment of aqueous fluids comprising applying a scale removing and disinfecting effective amount of electrical direct current thereto, said treatment having a combined effect of scale removing and disinfecting.

The present invention further provides an aqueous fluid treatment device useful in scale removing and disinfecting which comprises an electrical direct current source, which is in electrical contact with at least one electrode at each pole thereof, said electrodes being immersed in said aqueous fluid.

The amount of direct current applied to said aqueous fluids varies according to the type of fluid. For example, in the case of the treatment of cooling water, the preferred amount of direct current applied thereto is about 1A/5m^3/hour.

Preferred aqueous fluids are selected from the group of, but not limited to, drinking water, tap water, agriculture water, industrial water, sea water and sewage water.

Preferably, the pH of said aqueous fluid is about 7 or more.

Preferably, the device of the present invention is applied in any of watering system, cooling system, heating system, water supplying system, and fogger. Said watering system is selected from the group of, but not limited to, drippers, sprinklers and foggers. Said cooling system is selected from the group of, but not limited to, cooling towers. Said heating system is selected from the group of, but not limited to, kettles, boilers, washing machines, dish-washers, quick water heaters, evaporators, radiators, steam generators, steam irons, steam cleaners, module water heaters, heating boosters, thermal convectors, greenhouse heaters, and central heating systems. Said heating system is selected from the group of, but not limited to, showers, sinks, bidets, bathtubs, Jacuzzis and pools.

Optionally, the method of the present invention further comprises filtering the aqueous solution, and thus the device of the present invention optionally further comprises, in case said device includes a liquid outlet, a filter connected to said outlet, through which the electrically treated aqueous fluid is driven.

Detailed Description of the Invention

The present invention provides a method of treating aqueous solutions which shows a combined effect of scale removing and disinfecting. Such a method can meet a need of many systems in which the both effects are required, for instance, agriculture systems, wherein water is distributed through narrow nozzles of sprinklers, drippers and foggers and a small quantity of scale and/or biofilm is liable to cause a blockage of said nozzles.

An aqueous fluid treatment device of the present invention is in the form e.g. of a unit which comprises a liquid container having at least one liquid inlet and one liquid outlet, e.g. a pipe, further comprising at least one cathode and one anode placed within said liquid container, said cathode and anode being in electrical contact with the "-" and "+" poles of a direct current source, accordingly. Said liquid inlet is connected to a water source, and said liquid outlet is connected to a target system, e.g. sprinklers, drippers and foggers in which the disinfected, scale removed water is desired.

Furthermore, the present invention meets the need of disinfecting liquids and removing scale therefrom in systems wherein it is required to maintain the pH of about 7. In the present process, the pH changes only locally, near the electrodes. Whereas in other systems wherein chemicals are added, the pH changes homogeneously, and may cause problems such as corrosion.

In the event of the employment of said process in the treatment of cooling water, the blowdown stream can be used in a wide range of applications, e.g., agriculture watering.

The present invention can be applied by means of any electrolytic cell. Such a cell is described e.g. in Whitten et al., "General Chemistry with Qualitative Analysis". *Saunders College Publishing*, 4th ed., pp 12-13.

pipe one on each other side of said anode board and each of said cathodes are facing said anode.

Detailed Description of a Preferred Embodiment

The water treatment device of the present invention can be in a form as illustrated in Figure 1, wherein the pipe therein is a plastic pipe 60 inches long and of a diameter of 10 inches, the anode is a rectangular board made of titanium, the two cathodes are each rectangular boards made of stainless steel. Said three electrodes are each 50 inches long and 5 inches wide. The distance between each of the cathodes and the anode is 3 inches.

Examples

Example 1 (comparative)

A stream of non-treated water was used in a fog-generator used in a green-house in which tomatoes were cultured for the purpose of cooling and keeping the temperature at a steady level of about 25-30°C. Due to the precipitation of scale and the growth of microorganism and algae around the nozzle, a blockage occurs at the nozzle and the utility of said nozzles is terminated. The average life time of the nozzles in said system is 3-4 days.

Example 2 (comparative)

A stream of water treated by reverse osmosis was used in the same system as in Example 1. The average life time of the nozzles in this case was 1-2 months.

Example 3

A stream of water treated by DC current according to the present invention was used in the same system as in Example 1. After three months there were no blockages registered in any of the about one thousand nozzles, and the upkeep of said nozzles was spared. Due to the employment of the direct current treatment device of the invention, the

chemical additives and was applicable for a wide range of uses. Tomatoes that were watered with said treated water, showed no decay of growth. These results show a substantial improvement over those of examples 1 and 2.

Example 4 (comparative)

A stream of non-treated water was used in a cooling tower. After 2 weeks a substantial layer of biofilm and scale was noticed on the walls of the tower. The water in the tower was cloudy.

Example 5 (comparative)

A stream of water treated by polyphosphonates, thiocyanates, sulfonic acid and corrosion inhibitors at a pH of less than 8 was used in the cooling tower of Example 4. As a result, the pH was unstable and scale and biofilm appeared on the walls of the tower and were removed every 3 months in order to allow the proper use of the tower. Metallic elements showed some corrosion. The water in the water was cloudy and was not useful for watering and process.

Example 6

A stream of water treated by DC current according to the present invention was used in the system of Example 4 at the time that a layer of

biofilm and scale was already present. After 2 weeks said layer disappeared and the water in the tower was clear. No corrosion was registered. The blowdown flow was useful for watering and process. Due to the employment of the direct current treatment device of the invention, the water was disinfected to the extent not only that further biofilm did not appear on the walls of the tower, but the existing biofilm vanished. The clear water, the scale and biofilm removal, and the "green" use of the blowdown flow of the present example show a substantial improvement over the results of examples 4 and 5.

The foregoing description and examples have been provided for illustrative purposes only, and are not intended to limit the invention in any way. It will be apparent that many modifications, variations and adaptations may be made to the invention by persons skilled in the art, without departing from the spirit of the invention or exceeding the scope of the claims.

Claims

1. A method of treatment of aqueous fluids comprising applying a disinfecting and scale removing effective amount of electrical direct current thereto, said treatment having a combined effect of scale removing and disinfecting.

2. A method according to claim 1 wherein said aqueous fluid is selected from a group which consists of drinking water, tap water, agriculture water, industrial water, sea water and sewage water.

3. An aqueous fluid treatment device useful in scale removing and disinfecting which comprises a direct current source, which is in electrical contact with at least one electrode at each pole thereof, said electrodes being immersed in said aqueous fluid.

4. An aqueous fluid treatment device according to claim 3 wherein said aqueous fluid is selected from a group which consists of drinking water, tap water, agriculture water, industrial water, sea water and sewage water.

5. An aqueous fluid treatment device according to claim 3 for use in agriculture watering systems.

6. A device according to claim 5 wherein said watering systems are selected from the group which consists of drippers, sprinklers and foggers.

7. An aqueous fluid treatment device according to claim 3 for use in a cooling system.

8. A device according to claim 7 wherein said cooling system is selected from the group which consists of cooling towers.

9. An aqueous fluid treatment device according to claim 3 for use in a heating system.

10. A device according to claim 9 wherein said heating system is selected from the group which consists of kettles, boilers, washing machines, dish-washers, quick water heaters, evaporators, radiators, steam generators, steam irons, steam cleaners, module water heaters, heating boosters, thermal convectors, greenhouse heaters, and central heating systems.

11. An aqueous fluid treatment device according to claim 3 for use in a water supplying system.

12. A device according to claim 9 wherein said heating system is selected from the group which consists of showers, sinks, bidets, bathtubs, Jacuzzis and pools.

13. An aqueous fluid treatment device according to claim 3 for use in a fogger.

14. An aqueous fluid treatment device according to claim 3, wherein the pH of said aqueous fluid is about 7 or more.

15. A method according to any one of claims 1 and 2 which further comprises filtering the electrically treated aqueous solution.

16. A device according to any of claims 3 to 14 which further comprises a filter connected to the outlet of said device.

לוצאטו את לוצאטו
LUZZATTO & LUZZATTO
By: ע"י:

4505/97
U.E.T. RECYCLING OF INDUSTRIAL WATER LTD.

One Sheet of Drawings

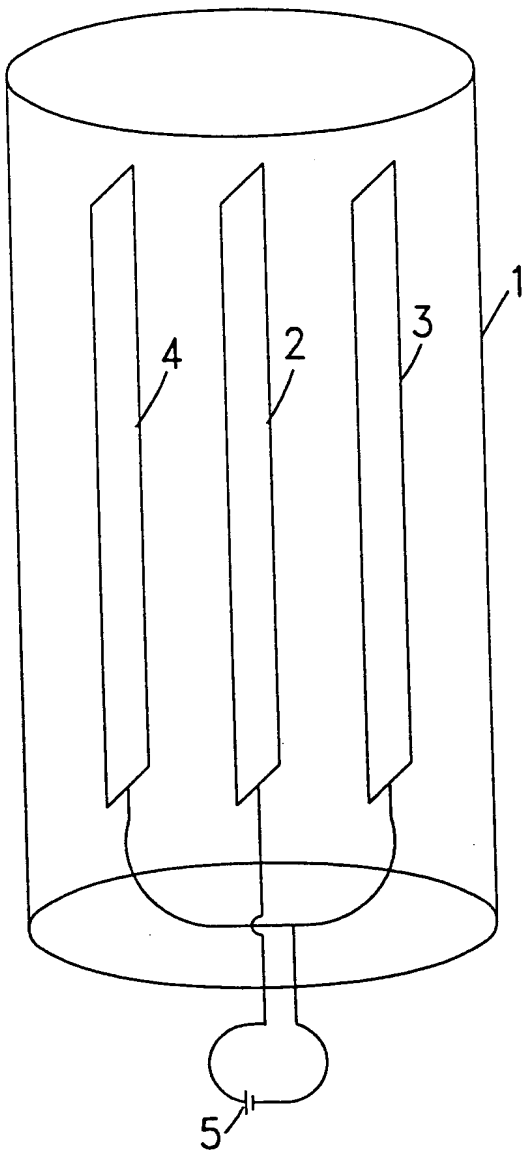

Fig. 1